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PURPOSE

The programmatic objectives of this investigation involve theoretical and empirical research directed toward problems of accounting for the effects of the social and physical characteristics of the environment in the study of behavior. The principle that behavior is determined simultaneously by inner and outer forces has been variously represented by schematic interaction equations, but very little has been done systematically to implement the use of such equations by specifying a taxonomy of environmental (or situational) variables. These problems have received major attention in the present investigation.

A preliminary taxonomic analysis of the environment was presented in Technical Report No. 1, the proceedings of a symposium at Texas Christian University, and also in a book, Stimulus Determinants of Behavior, edited by the Principal Investigator and published by the Ronald Press in 1963. During the past year, further theoretical and empirical contributions have been made on this subject.

WORK ACCOMPLISHED

The theoretical papers, Technical Reports 3 and 4, have explored the significance of the environment for behavior in phylogenetic and ecologic perspective. These views were

first presented to the Colloquium of the Department of Psychology at the University of Illinois on March 8, 1963, with the title "The Significance of the Term Environment in the Behavioral Interaction Equation." They were developed more fully in an address to the Southwestern Psychological Association on April 5, 1963, which will appear in the November, 1963 issue of the American Psychologist. A further statement was included in a paper entitled "Approaches to the Taxonomy of Social Situations: Task or Situation," presented at a symposium at the American Psychological Association, August 30, 1963.

The empirical studies conducted during the past year have been primarily methodological and are reported briefly under three headings: (a) Taxonomic Analysis, (b) Analysis of Group Dimensions, and (c) [redacted] Day-to-Day Fluctuation in Anxiety Level.

a. Taxonomic Analysis. A methodological study has been carried out involving the classification of individual demographic and social background factors with reference to the effects on academic achievement, selection of major field of study, and career choice for a sample of 286 TCU undergraduates. A matrix of 186 variables including, in addition, the Cattell 16PF test, the Thurstone Interest Schedule, the

Eysenck Social Attitude Inventory and Criterion information abstracted from college records, has been analyzed. A cluster analysis using 120 non-linearly dependent variables was carried out by Tryon's modification of the Holzinger and Harman B-coefficient method. Twenty-three clusters composed of three or more variables were obtained and are now being compared with the results of a factor analysis. Twelve of these, including primarily situational variables, were presented in the APA symposium report (Technical Report No. 4) and are summarized here as follows:

Cluster 1

91. major or minor subject Religion vs. not Religion,
101. intended career Religious vs. not Religious,
115. subscribes to Religious magazines vs. does not subscribe,
97. receives scholarship vs. no scholarship.

Cluster 2

8. year of graduating class,
42. number of semester-hours of credit earned,
1. age (years),
10. number of years of college attendance,
96. no allowance received (from parents) vs. allowance received,
77. amount of personal income (per year),
84. married vs. single,
15. number of hours per month of work on job while at school,
40. total time spent in work and other group activities.

Cluster 4

2. height,
3. weight,
83. male vs. female,
67. Cattell 16 PF Factor N, sophisticated, polished,
14. total number of jobs held,
59. Cattell 16 PF Factor C, mature, calm,
76. low academic achievement (grade point average).

Cluster 7

34. number of years of schooling of father,
38. composite of educational level of family,
35. number of years of schooling of mother,
36. parents' income.

Cluster 9

17. time required to travel to and from school,
104. off-campus residence vs. on campus,
18. number of household chores performed,
19. number of appliances in residence,
108. does not travel to visit family vs. does travel.

Cluster 13

120. has no children,
84. single vs. married,
98. has no bank account vs. has bank account,
27. number of hours of sleep per night.

Cluster 14

90. no interruption of education vs. interruption,
102. not served in Armed Forces vs. served in Armed Forces,
95. no interruption due to illness vs. interruption,
93. no interruption due to financial difficulties vs. interruption,
113. never outside of continental U.S. vs. outside.

Cluster 19

6. population of town where high school is located,
75. number of students in high school graduating class,
7. age at graduation.

Cluster 21

112. does not smoke vs. smokes,
56. Eysenck scale, tender minded vs. tough minded,
21. frequency of church attendance per month.

Cluster 22

43. overall grade point average,
58. Cattell 16 PF Factor B, bright, intelligent,
9. number of class hours carried in 1962.

Cluster 23

4. years lived in home town,
89. live in Texas vs. do not live in Texas,
88. no diseases experienced vs. diseases experienced.

Cluster 26

25. number of letters written per week,
109. meals eaten out or in school cafeteria vs. at home,
105. no privacy for study vs. privacy,
114. does not read newspapers vs. reads newspapers,
110. does not have a car vs. has car,
85. Protestant religion vs. other.

These clusters, subject to verification by factor analytic methods, are presumed to represent various patterns of constraint represented on the lives of those described by them. It is planned

to identify groups of individuals exemplified by the cluster scores and to investigate variations among people so described on the criterion variables.

b. Analysis of Group Dimensions. Data have been collected on approximately 922 undergraduates, representing 59 campus organizations at TCU, on the Hemphill Group Description questionnaire and a specially designed survey form focused on individuals' status in group, identification with group, and participation in group. The 59 groups included eight religious organizations, eight honorary societies, eight departmental clubs, fifteen ROTC classes and sub-groups, ten committees of the student self-government, two varsity athletic teams, and eight fraternities. Independent data on group goals and objectives enables the classification of groups into the categories mentioned. Questionnaire profiles have been completed and are being analyzed with regard to: 1. variation among groups in modal patterns, 2. variation within groups, 3. variation in relation to group identification, member status and member participation. A preliminary inspection of group profiles indicates significant variations between fraternal,

military, scholastic, and student government groups as shown in the following tabulation of mean stanines for four groups:

Hemphill Group	Fraternity	Military Group ROTC	Business Education Club	Special Events Committee
Control	5	7	5	3
Stability	5	5	7	6
Intimacy	8	4	5	6
Stratification	4	8	5	4
Hedonic Tone	5	3	5	5
Autonomy	6	2	6	3
Potency	7	6	5	5
Viscidity	6	4	5	7
Permeability	5	6	6	7
Participation	5	5	4	5
Polarization	5	6	5	4
Flexibility	3	2	4	6
Homogeneity	6	6	8	6

As can be seen, these profiles show interesting and meaningful variations. For example, the military group exhibits high perceived control and stratification with low intimacy, while the fraternity is highest in intimacy and potency and lowest in stratification and flexibility.

c. [redacted] Day-to-Day Fluctuation in Anxiety Level. During the past year a brief anxiety questionnaire, appended to this section, was administered to 31 students in a social psychology class at every class meeting for an entire semester.

The mean score over the entire semester correlated significantly ($r = .66$) with the second order anxiety factor of the Cattell 16 PF test. Variations among individuals appeared to be greater than those between occasions. However, these data are being analyzed with relation to a number of significant events during the semester.

SCOPE OF WORK TO BE UNDERTAKEN

In an effort to arrive at more complete understanding of the effects of situational factors on behavior, it is planned to interview samples of students defined by the clusters in study (a), above with reference to day-to-day patterns of activities and factors related to their performance. In these interviews, particular attention will be directed to sources of commitments, such as schedules, requirements of organizational membership, scholastic assignments, social obligations, family obligations, housekeeping and personal needs, and the like. Such interviews will cover blocks of one week at a time and will be coded in relation to time devoted to various activities, types of activities, sources of commitment, and cause. These will in turn be related to cluster membership and organizational memberships as described above. Although this work is

exploratory in nature, it is recognized as a necessary next step in the investigation, which is required to dilineate situational influences in greater detail than has been possible with the instruments utilized thus far. The previous instruments have concentrated on long term aspects of individual lives, while the inquiry outlined here will provide more of a microanalysis, in real time units.

PERSONNEL

Principal Investigator	S. B. Sells, Ph.D. Professor of Psychology and Director Institute of Behavioral Research
Research Assistant	Nurhan Findikyan Graduate Research Fellow in Psychology
Undergraduate Assistants	Richard W. Tedham Stanley D. Brown

Submitted by _____

S. B. Sells
Principal Investigator

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Technical Report No. 3. An Interactionist Looks at the Environment. by S. B. Sells (mimeo) 5 April 1963.

Technical Report No. 4. Approaches to the Taxonomy of Social Situations: Task or Situation. by S. B. Sells (mimeo) 30 August 1963.

Sells, Saul B. (Ed.) Stimulus Determinants of Behavior, New York: Ronald Press, 1963, 246 p.

Name_____ Date_____

Check every item that reflects how you feel right now.

___ 1. headache

___ 2. pressure in head

___ 3. back of neck stiff and sore

___ 4. queer unpleasant feelings in body

___ 5. excessive perspiration

___ 6. upset stomach

___ 7. cold hands/or feet

___ 8. difficulty in concentrating

___ 9. wet, clammy hands/or feet

___10. dizzyness

___11. feel faint

___12. difficulty breathing

___13. heart beats too fast

___14. shaking and trembling

___15. fidgity and restless

___16. excited or nervous

___17. sensitive to noises

___18. jumpy or easily startled

___19. annoyed by loud people

___20. annoyed by grating or repeated sounds

21. ___ringing or buzzing in ears

22. ___mist before eyes

23. ___insomnia or sleeplessness

24. ___hard time waking up

25. ___unpleasant or scary dreams

26. ___poor appetite

27. ___eat too much

28. ___exhausted

29. ___tired for no reason at all

30. ___worry about health

31. ___worry about the future

32. ___worry about money

33. ___fearful of accidents

34. ___fearful of failure

35. ___frustrated or beaten

36. ___angry or resentful

37. ___sorry for self

38. ___wish I were dead

39. ___unduly irritable

40. ___depressed

two models stand as symbols of divergent research strategies, with zealous advocates and adherents on both sides.

Both approaches accept the principle of the multiple determination of behavior. But they differ fundamentally in their concepts for dealing with background and secondary sources of variance not directly involved in the processes under investigation. The traditional method of choice, in the bivariate model, is that of isolation of the dependent and independent variables, either by experimental control or by randomizing procedures, while the more recently developed multivariate model involves simultaneous (statistical) consideration of all measurable factors. In practice, the bivariate model has been that of the experimental laboratory, with all of the implications of artificiality associated with isolation, and the multivariate model has been that of the field study, with corresponding implications of lack of rigorousness and incompleteness of coverage of relevant variables.

Both approaches have thus fallen short of ideal realization as a result of practical limitations on data collection and inadequate systematic knowledge concerning the universes of relevant variables to be controlled or incorporated in the data matrix. In fact, much basic research remains to be done on the universes of variables representing individual differences in species-characteristic behaviors and

environmental sources of variance in behavior for different species. These problems will be discussed further, below.

Advocates of the bivariate approach appear to regard isolation of experimental effects as advantageous and necessary to the understanding of behavioral phenomena to the extent that they remove the "contaminating" effects of concomitant processes, despite the fact that the phenomena in question do not occur in isolation. To what extent this position reflects attitudes of allegiance to laboratory traditions as the sine qua non of scientific purism, and of distrust of statistical methods of estimation, cannot be stated. However, behavior is complex and patterned and is jointly determined by the direct and indirect effects of many internal and external factors whose contributions to the variance of even simple behaviors is essential to their understanding. Experimental controls eliminate effects whose weight, in multidetermined behavior, needs to be evaluated rather than excluded or ignored.

An unfortunate traditional cleavage in psychology, in which content areas have separated along the lines of the methodological dichotomy (e.g. bivariate-experimental and multivariate-psychometrics, personality, social) is only just beginning to show signs of breaking down. Multivariate analysis of variance designs, multiple discriminant analysis, factor analysis, multiple regression, canonical

correlation, and other parametric and nonparametric statistical procedures have long been making significant inroads over the entire spectrum of psychological research. This trend has been greatly accelerated during the past 3 to 4 years by important advances in multivariate methods contributed by such men as Guttman, Kaiser, Wrigley, Cattell, Harris, Torgerson, Carroll, Tucker, and others too numerous to mention, and by the associated and enabling event of the large-capacity, high-speed computer. The new methods, which are beginning to be elucidated in such impressive books as those of Borko (1962), Cooley and Lohnes (1962), Harman (1960), and Ralston and Wilf (1962), are adapted to these new computers and have virtually made obsolete all methods of computation that were in vogue as recently as five years ago.

Powerful analytic multivariate methods are no longer either an impracticable luxury or an autistic fantasy. They are rapidly becoming commonplace realities in the larger centers of research and the day is near when prejudice and traditional bias will no longer shield those who refuse to meet the study of behavior in its indigenous locales and with all of its associated complexities. It is now reasonable to expect the experimental psychologist working with human subjects and the comparative psychologist, with each species, to consider

more seriously the dimensional nature of the behavior repertoire and the measurement characteristics of his apparatus, as well as the dimensions of the environments in which the behavior occurs.

THE PRINCIPLE OF INTERACTION

The principle of interaction reflects, in my opinion, an adaptive process rather than a random encounter between inner and outer forces. This process involves a polarized accommodation of organism to environment, not only at the level of molar behavior, but in all biological functioning, of which molar behavior is one manifestation. Adaptive interaction need not, in this discussion, imply a hormic philosophical premise, but only the generalization of relationships observed at every level of functioning of living organisms: in the geologic record of the earth, in the phenomena of natural selection and ecology of species and strains, in genetics, maturation and growth, and in individual and group behavior.

The biological, phylogenetic perspective was explicit in Dobzhansky's Silliman Lectures at Yale in 1959, when he formulated the principle of adaptive interaction as integral to change in the genetic endowment of a species and in the structure of a society. He credited Simpson (1944, 1953) and Rensch (1947, 1959) as showing that there is nothing in the data of paleontology or morphology

to warrant any other (ectogenetic or autogenetic) conclusion, Lysenko and others of his persuasion notwithstanding. The biological theory of evolution, as Dobzhansky terms it,

"recognizes that adaptation to the environment is the main causative agent of organic evolution. In this sense, evolutionary changes come from the environment. Assertions by Lysenko and his henchmen, that geneticists deny that the genetic endowment of a living species can be changed by the environment, are nonsense. The point is, however, that the changes are mediated by natural selection. And it is because the changes are brought about by natural selection that most of them further the congruity between organism and environment. On the other hand, the environment does not impose changes on the organism... A living species may respond to the challenges of the environment by adaptive alterations. But...it may not respond adequately and die out or become less well adapted. The response depends on the availability at the proper time and place of mutations and gene combinations." (1959, pp. 16-18).

Elsewhere in the same book, Dobzhansky added,

"Selection occurs when two or more genotypically distinct classes of individuals transmit their genes to the succeeding generations at different rates. The rate at which the carriers of one genotype propogate their genes relative to other genotypes is the measure of Darwinian fitness or adaptive value of these genotypes."

Biological adaptations are both hereditary and non-hereditary. Hereditary adaptations can be illustrated in man by variations in many morphological characteristics, such as body types in relation to heat control (Eskimo vs Equatorial African), skin pigmentation in relation to shielding against ultraviolet and other radiations (Africans vs Northwestern Europeans), distribution of muscles and structure of bones (forest dwellers vs plainsmen), physiological adaptations to high altitude (the large chests, great depth of respiration, richness

of blood in hemoglobin of Aymara Indians of Lake Titicaca region of Peruvian Andes), the sickle-cell trait of certain tribes of African Negroes, which has a low mortality, but gives its survivors high immunity to malaria, and which occurs also among non-Negroes in areas where malaria is prevalent, to mention only a few.

Dubos (1961) has reported an unusual case of adaptation found in aborigines in Central Australia, who live in a region of exceptional dryness and face extraordinary problems of water supply. Rainfall there is less than 10 inches per year and temperatures reach 140° F.

"In addition to having developed an extraordinary instinct for discovering water where white men would die of thirst, these aborigines exhibit physiological adaptations that permit them to survive with very small amounts of the precious fluid. They are able, for example, to use their stomachs as water bottles in which large volumes can be stored. Their enormously distended stomachs are the evidence of storage whenever they start for a trip across the desert from a place where water is available. A European, drinking large quantities of water, rapidly excretes the excess once his physiological requirements have been met. In contrast, the stomach in the Aborigines is able to retain the water and let it out as needed, over many hours. Furthermore, their kidneys seem to be so efficient that they apparently require only half as much water to flush the same amount of waste products as would be the case for white men - thus reducing greatly their minimal requirements."

Many examples of non-hereditary adaptation mechanisms, such as tolerances and immunities to various indigenous poisons and microbial organisms, adaptation to heat, cold, altitude, and

other environmental extremes are well known. Time does not permit a systematic survey, but mention of a few examples of other non-hereditary adaptive behaviors recorded by various observers will illustrate the ubiquitous nature of these processes.

Dubos has used the term "biological learning" to describe a wide range of behaviors practiced by different peoples to cope with environmental dangers already encountered in their past. These include many forms of primitive medicine and witch-doctory, tribal customs and taboos, religious beliefs and practices, and nutritional habits, which from one point of view are remarkably reminiscent of some of Jung's archetypes. Nutritional habits are particularly illustrative because their incredible diversity was cited by Dubos as often accounting for the survival of many primitive peoples under conditions that appear at first sight incompatible with human life. The rich fat diet of the Eskimo, the use of available plant products by the Chinese to enrich their diets with amino acids, the use of the calcium-rich chalk dishes in which the Mexican peasants grind corn to compensate for lack of calcium in their normal diet and their practice of drinking vitamin-rich pulque as a favored alcoholic beverage, all represent practices maintained over many generations under environmental conditions favoring their continuation.

The following doggerel verses, which appeared in the Journal of Abnormal and Social Psychology under the authorship of AFJ, in 1939, further illustrate the argument:

> The Arapesh eat a little flesh.
> They live secure, but futile.
> They're not competitive or harsh,
> As are the Kwakiutl.
>
> Bachiga think that food and drink
> Should come from lone endeavor.
> The Zuni, herding sheep in peace,
> Cooperate forever.
>
> Samoans feel the great ideal
> Is helping one another.
> Ojibwas try to stand alone
> And no one loves his brother.
>
> The Maori loaned whate'er they owned
> From Kingdom Come til now;
> But interest rates are very high
> Among the Ifugao.

These last quotations extend the discussion to behavioral interactions and call attention to a major point, that the interaction process constantly occurs simultaneously and interrelatedly at several levels of organismic functioning and is truly a biosocial process. This aspect is beautifully and forcefully demonstrated in the monumental developmental work of Piaget, which Hunt (1962) has recently enriched by his excellent interpretive review. Piaget's observations and experiments indicate that the behavior and thought

structures comprising intelligence are continually changing as a consequence of the accommodation and assimilation involved in a person's encounters with the environment. Hunt has interpreted these processes as showing that experience, defined as the organism's encounters with the environment, is continually building into the developing organism a hierarchy of operations for processing information and for coping with new circumstances encountered.

Many examples of behavioral adaptation to environmental circumstances can be found in the behavioral science literature. Of principle interest in the present context are critical, quantitative studies which in some way assess the contributions of various factors in the situations studied to the behavior observed.

Blake and Helson (1956), working under an Air Force contract for which I had responsibility, carried out a series of laboratory experiments in which the effects of certain person and situational variables and their interactions were evaluated jointly. Using both attitude and perceptual judgments in a simulated group situation, in which the stimuli, and the responses of all but the experimental subject, were presented over an "inter-com" by tape recording, they demonstrated that the responses of experimental subjects are predictable interactions reflecting the effects of identifiable person variables, group norms (as programmed for the simulated group members), and

stimulus characteristics. In one experiment, students shifted generally from attitude positions expressed in the alone situation, on Thurstone attitude-toward-war items, to the center of the clustered group expressions, when tested in the simulated group. However, submissive subjects (measured on the Allport-Vernon ascendance-submission scale) shifted significantly more than ascendant subjects, and, in the particular sample tested, pro-war items were favored over neutral and anti-war items. In other experiments it was found that group norms were more influential on anonymous than public responses, that group norms were influential when discrepancies were large than small, and when the tasks were unstructured rather than structured.

An impressive series of empirically focused studies analyzing behavioral adaptations to a wide range of social, environmental circumstances is presented in the symposium on Stimulus Determinants of Behavior (Sells, 1963) referred to earlier. Muzafer and Caroline Sherif showed the effects of varied socioeconomic and ethnic situations on judgments, such as what is the appropriate amount to spend for clothes or gifts, what is an appropriate allowance for spending money, and the like. Bernard Mausner, using a two-partner simulated Civil Defense observation task, demonstrated the influence patterns of such

variables as information about partner's performance, religion, confidence concerning own performance, and reaction time of subject and partner, on judgments. Bernard Bass manipulated organizational structure and administrative climate of simulated manufacturing organizations and showed how these variations affected performance of individuals and groups. Roger Bellows developed a measure of cooperation-authority for organizations and demonstrated a significant relation between it and the Brayfield-Roth job satisfaction scale in a diverse sample of 135 organizations. Edgar Borgatta studied experimental three- and five-man groups with regard to interpersonal effects on performance and demonstrated such effects as antagonism of one subject as a function of the degree of assertiveness displayed by his coparticipants. And finally, Thomas Milburn, in a discussion of deterrence in international relations, analyzed the influence of threat on decision-making.

To summarize this lengthy section, we have reviewed adaptation of organism to environment in biological functioning and in behavior. Adaptive interaction is demonstrated in behavioral development as well as in natural selection and ecologic adjustment. Although individual experiments have been cited in which variance attributable to person variables, situation (stimulus) variables, and

interactions has been analyzed, these have been confined to single, or at best, small numbers of variables and have fallen far short of accounting for any major portion of total variance. It must be acknowledged that multivariate behavioral research incorporating the interaction model has not yet advanced very far. Certainly the broad approach, proposed by Parsons and Shils (1951), involving three independent systems, of action, personality, and social system-culture remains a grand strategy in search of implementation.

The most obvious need in evaluating the manifold encounter of organism and environment is a more satisfactory and systematic conceptualization of the environment. This implies a taxonomic, dimensional analysis of stimulus variables comparable to the trait systems that have been developed for individual difference variables. However unsatisfactory and incomplete these may be, the presently known primary dimensions of abilities and personality of adult man have been found to account for major proportions of variance in behaviors to which they have been appropriately related. While work proceeds actively to extend the exploration of individual differences, however, the equally important frontier of situational dimensions is virtually ignored.

In the absence of clear perception of the basic dimensions of the total stimulus situation, experimenters must have systematic information about relevant dimensions of the environment beyond the

piecemeal, concrete, immediate variables customarily observed on the basis of experience.

The distinction between piecemeal, concrete, or what Cattell calls surface variables, and dimensions is analogous to that between test items and factor scores. To illustrate the necessity of regarding the environment in terms of dimensions, rather than discrete variables, I would like to report some preliminary data from our laboratory, obtained in collaboration with Mr. Nurhan Findikyan, of a study supported by the Office of Naval Research, listing a number of specific items that we have found to be significantly correlated with grade-point average for a sample of 286 undergraduate students at Texas Christian University. Most of these appear to represent interactions of various person-situation variable patterns, but the list suggests significant patterning of these items on a dimension of conduciveness to academic achievement.

smoking:	(degree)	-.23
	dichotomous	-.24
religious behavior:	church attend. freq.	.16
	attendance at lectures	.11
	membership	.11
academic status:	year level (freshman, etc.)	.16
	no. courses in Spring 1962	.11
	no. hours carried in Spring 1962	.12
	no. credit hours/years in school	.37
	no. hours credit earned	.15
	no. credit hours/years in school	.37
	Freshman grade-point average	.77
	Rank in H.S. graduating class	.43

school attendance: no days missed, present semester	-.11
no. days missed, illness	±.12
interruption of studies, financial	-.11
interruption of studies, probation	-.16
study habits: no. hours per day	.17
no. of periodicals and journals read	.13
no. of books read yearly	.12
activities: no. different events attended/month	-.12
no. of games played	-.12
frequency of games played/month	-.18
participation in sports	-.19
no. of group membership	.17
gender (male-female)	-.19
awards received: no. received	.15
dichotomous (any vs none)	.21
scholarship vs none	.23
chosen career requires graduate work	.11
duration of visits to family	-.31
bank account vs none	.15
ownership of car	-.11
family: parents divorced	-.14
population of father' s birthplace	-.17
population of mother' s birthplace	-.13

ECOLOGY, ETHOLOGY, AND PSYCHOLOGY

The continuing stream of life, from the first primitive organism to the most recent and advanced, reflects a continuing transaction between organisms and environments, in which both long-term trends (reflecting natural selection in the evolutionary perspective) and short-term adjustments (ontogenetic adaptations, modifications by learning, and transient adjustments) collectively contribute to the definition of the ecologic niches of species and individuals.

From the foregoing discussion it seems reasonable to infer that differences among species, and viewed more microscopically, differences among individuals, reflect historical patterns of adaptive interactions of organisms with different environmental conditions. For every species of living organism there is a particular pattern of environmental dimensions, corresponding to what is usually referred to as an ecologic niche, which represents its naturally selected match between circumstances and species schema (to use Hunt' s terms).

The behaviors related to survival and typical functioning in the ecologic niche of every species are the behaviors with which psychology must be primarily concerned. In the frame of reference of this presentation, these are the significant behaviors to be specified in the multivariate behavioral interaction equations, which are specific to each species. Although comparative generalizations across species are of special interest to psychology, the problems of dimensionalization of response repertoires, and of the environment must be repeated for each species. Until this is done, we will never have a truly comprehensive comparative general psychology.

This view has been developed independently by the relatively new discipline of ethology and has recently received extensive support from the expanding literature of the ethologists and psychologists who

have embraced their problems. For instance, Tinbergen (1957) has argued that, "Facts found in one species, or hypotheses formed about one species, simply cannot be disproved by testing another species, under however well controlled laboratory conditions."

In a different, but equally relevant context, and more positively, Bindra (1959, p. 292), wrote:

" The species and strain differences in the readiness with which certain directed activities can develop can be attributed to jointly (a) the species and strain differences in the frequency of occurrence of the component responses that make up an activity, and (b) the differences in the efficacy of certain objects and events as reinforcers for members of different species and strains."

Following this statement, Bindra added, "The precise constitutional, morphological, and experiential factors that determine these species and strain differences remain to be investigated."

As the shock troops of aspiring doctoral candidates, and indeed, the well financed major laboratory programs, rise to meet this challenge, I would express the advice, for the terminology of which I am indebted to Keller Breland, that an experiment should always be conceived as an ecologic surrogate; and equally important, as a multidimensional investigation.

My personal research has been at the human level, where these strictures are not only equally relevant, but considerably more difficult to implement. Homosapiens is not a homogeneous

species, as I (perhaps innocently) believe most animal species to be. With man, we must reckon with an extensive geographic distribution and infinite variations of morphology, culture, and social organization. Our research on the development of a taxonomic system of environmental dimensions relevant to human behavior (Sells, 1963) is in fact restricted to a relatively confined geographic area and our own subculture. Although in the present context it appears frightfully microscopic, the difficulties encountered have at times seemed overwhelming. However, we keep our eyes on the interaction equation and recognize that if behavior is to be represented as a multidimensional interaction of the universes of person variables and environmental variables, psychology cannot advance productively until the environment universe is specified.

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